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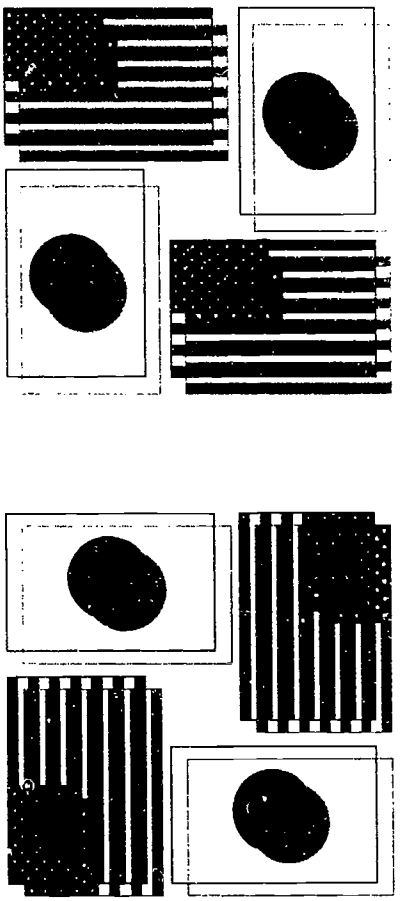
ABSTRACT

The purpose of this study is to present a profile of the Japanese educational system by comparing and contrasting it with the U.S. system. This profile provides the educational and social contexts within which the two educational systems function, so that the differences in standards and outcomes may be understood better and replicated. The objective of this comparison is not to advocate the replication of the Japanese educational system and practices, but to promote a better understanding of the strengths and weaknesses of both systems. An overview of the Japanese system is presented including a brief historical background, cultural foundation, formal educational structure, teacher characteristics, school finance, equality of opportunity, and issues facing the system. Comparisons are made between the U.S. and Japanese educational systems in terms of purpose of education, time devoted to learning, curriculum standards and implementation, motivation for educational achievement, classroom organization, parental roles in education, teaching profession, and school expenditures and resources. Finally, policy implications of the Japanese educational system for the U.S. system are discussed. A list of references and three appendices also are included: (1) required weekly class periods in each subject in elementary schools in Japan; (2) required weekly class periods in each subject in lower secondary schools in Japan; and (3) general education subjects in Japanese upper secondary schools and the number of credits for each subject. (DB)

A CROSS-CULTURAL COMPARISON OF THE AMERICAN AND JAPANESE EDUCATIONAL SYSTEMS



THE UNIVERSITY OF THE STATE OF NEW YORK
THE STATE EDUCATION DEPARTMENT
OFFICE FOR PLANNING, RESEARCH AND SUPPORT SERVICES

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THE UNIVERSITY OF THE STATE OF NEW YORK
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March 1992

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"we should look for principles, emphases and relationships in Japanese education that are compatible with American values, indeed that tend to embody American values (as well as many findings of education research), to see how we might borrow and adapt them ourselves."

"the structures, policies and practices of modern Japanese education have been influenced in no small part by that nation's remarkable knack for borrowing an idea and then adapting it, working it out in detail, and executing it with thoroughness and finesse in the Japanese context. And at least a few of the ideas and approaches used in education in Japan can be traced to American influence four decades ago."

--William J. Bennett
Former U.S. Secretary of Education
January 1987

INTRODUCTION

Background

Unlike the multicultural society found in the United States, Japan is a homogeneous nation with one national language, one race, and a strong sense of cultural identity and national unity. Since World War II, Japan has become an economic, industrial, and technological superpower and a major competitor of the industrialized West, particularly the United States. It has been suggested that the basis for this strength may be found in Japan's educational system. Known to produce a highly literate work force, Japan's educational system graduates 95 percent of its youth from high school. In addition, its high school graduates score higher in mathematics than do graduates anywhere else in the world. However, Japanese education is frequently criticized for the high level of stress it exerts on children, the rigidity, and the excessive high school and university examination systems.

Recent international comparison studies have shown higher achievement scores by Japanese students compared to their American peers in science, mathematics, reading and other academic areas. (International Association for the Evaluation of Educational Achievement, 1988; Travers and Westbury, 1989; Robitaille and Garden, 1989; Stevenson and Lee, 1990) In the Second Science Study conducted by the IEA, Japanese fifth and eighth graders have ranked first and second among seventeen countries, while their American counterparts scored eighth and fourteenth, respectively. In the second IEA Mathematics Study, Japanese eighth and twelfth graders ranked first and second in all mathematical areas among 20 participating countries, while their American counterparts ranked seventh and eighteenth. In addition, 48 percent of the Japanese students taking the mathematics tests were categorized as high achievers compared to only two percent of American students in the same category. Most alarming is that this pattern of poor academic achievement by American students is evident as early as the first grade. (Stevenson and Lee, 1990)

What are the causes for these differences in academic achievement between American and Japanese students? What is the Japanese educational system doing differently from the American system? What can we learn from the Japanese system?

To improve public school education in New York State and throughout the Nation, we must begin to explore the answers to these questions. In seeking answers to these questions and advancing new national goals for education, President Bush and the Nation's governors have called for studies comparing American education with that of other industrialized nations. Also, in his 1990 State-of-the-State Address, New York's Governor Mario Cuomo called for studies focusing on the strength of State mathematics and science programs in relation to foreign competitors.

Purpose of the Study

The purpose of this study is to present a profile of the Japanese educational system by comparing and contrasting it with the American system. Such a profile provides the educational and the social contexts within which the two educational systems function, so that the differences in standards and outcomes may be better understood and interpreted. The objective of such a comparison is not to advocate the replication of the Japanese educational system and practices, but to promote a better understanding of the strengths and weaknesses of both systems.

There are two paradigms in cross-national comparison studies of school achievement. One is the empirical tradition that prefers to treat differences in achievement as matters of degree. (Ragin, 1987) Following such an approach, school systems around the world are assumed to function within a uniform set of inputs, and differ only in degree of inputs. Variations in national outcomes are explained as a function of differences in the amount of common inputs such as time on task, quality of teachers, hours of homework, and

student motivation. It is argued that such a paradigm minimizes distinctive characteristics in the purpose and structure of national systems. (Cummings, 1991) The other paradigm is an economic analytical approach that focuses not only on the inputs and outputs, but also on the nature of the production function, such as the purpose and structure of education systems. This implies that the differences in cross-national educational systems should be treated in terms of essence, instead of degree.

Using both paradigms, this paper focuses on differences in essence, context, and the amount of inputs in both systems. An overview of the Japanese educational system is provided, including a brief historical background, cultural foundation, formal educational structure, teacher characteristics, school finance, equality of opportunity, and issues facing the system. Comparisons are made between the American and Japanese educational systems in terms of purpose of education, time devoted to learning, curriculum standards and implementation, motivation for educational achievement, classroom organization, and parental roles in education, teaching as a profession, and school expenditures and resources. Finally, policy implications of the Japanese educational system for the American system are discussed.

AN OVERVIEW OF THE JAPANESE EDUCATION SYSTEM

Brief Historical Background

Prior to the 1868 Meiji revolution, which set Japan to a modern course, the country was a feudal society, ruled by the Tokugawa family. The Tokugawa family established a government headed by the Shogun (military rulers). During this period, the country was closed to the outside world. Education for the most powerful class in Japan was based on military and literary studies. Literature was primarily Confucian classics, large portions of which were memorized and recited. Study of the martial arts consisted of swordsmanship and military tactics. Education for the commoners was more practically oriented, emphasizing the basic training in reading, writing, and arithmetic.

With the beginning of the modern era in 1868, the Meiji leaders made a conscious effort to create a public educational system that would help the country catch up to the West. Missions were sent abroad to study the educational systems of leading Western countries. Westerners were invited to advise new approaches for Japanese education. As a result, a new educational system of public schooling was systematically introduced throughout Japan in 1872. It was open to boys and girls alike and to all social classes. The new system endeavored to tap all of Japan's human resources in support of national objectives.

In creating a modern school system, Japanese leaders borrowed selectively from the West, primarily the United States. The initial modern school system was heavily influenced by American egalitarianism. After a decade of American influence, however, Japanese education was refocused on Chinese Confucianism for guidance, and Germany was found to be a model more congenial to Japanese traditions and goals. The 1890 Imperial Rescript on Education, which was the basis for Japan's ideology until 1945, stressed Confucian precepts, mainly concerning the hierarchical nature of human relations, service to the state, and the pursuit of learning and morality.

Immediately after World War II, the Japanese educational system was strongly influenced by American democratic values of equal educational opportunity. The American educational system was introduced in Japan during the United States' occupation of the country. The resulting changes included the 6-3-3-4 grade system (consisting of six years of elementary school, three years of lower secondary school, three years of upper secondary school and four years of higher education), the revision of curriculum and textbooks, (including abolishing moral education), reforms in the writing system, establishment of coeducation, support for equal access to higher education, and an attempt to decentralize the education system. However, shortly after the occupation period, some of the early changes in the Japanese education system were modified to reflect more clearly Japanese ideas about education and educational structure, including the restoration of moral education.

With Japanese advances in science and technology, and rapid economic growth, the Japanese educational system has grown concomitantly. Upper secondary schools were started in 1947 and universities in 1949. According to the most recent data from the Japanese National Institute for Education Research (NIER), between 1960 and 1989, the proportion of students enrolled in high schools increased from 58 to 94 percent, while the proportion of the age group enrolled in higher educational institutions increased from about 10 to 36.3 percent. Today's educational system still reflects the Japanese cultural and philosophical ideas that learning and education are esteemed and are to be pursued seriously, and that moral and character development is part of education. A meritocratic legacy stemming from the beginning of the modern period endures, as does a centralized educational infrastructure. Education is viewed as a function for national development, as well as a personal benefit.

Cultural Foundations

The Japanese culture was strongly influenced by Chinese civilization. Dominant among those influences were Buddhism, the Chinese system of writing, Confucian philosophical traditions and their classics. The Confucian heritage emphasized respectful, benevolent and hierarchical relations, harmonious social relations, and morality. Chinese ideas and systems were modified to suit Japanese circumstances and ideals, and were interwoven with Japanese philosophical and literary traditions.

Japan's culture and family life, it is argued, have major impact on the success of its educational system. The Japanese prefer to define themselves in a manner which emphasizes their core of commonly held beliefs and values. Although Japan has undergone dramatic changes since World War II, there remains a high degree of public consensus regarding societal values, appropriate standards of behavior, and the importance of education.

The Japanese commitment to education has its roots in history where learning and education are not only highly respected, but are considered the means to personal and societal improvement. As a result, the Japanese firmly believe that education is essential for both personal and national development and that it requires the active and sustained commitment of energy and resources at all levels of society. Parents and children take education seriously because success in school is a crucial determinant of economic and social status in adult life. Government policymakers and business leaders view the content and quality of public education as central to national cohesion, economic development, and international relations.

In the Japanese culture, schools are viewed as a moral community and a basic training ground for becoming a good citizen. Schools have a broad responsibility for not only the acquisition of academic knowledge, intellectual growth and vocational skills, but also moral education and character development. Teachers have the obligation and authority to impart fundamental Japanese values as the foundation of proper moral attitudes and personal habits. These responsibilities are viewed equally in importance to the academic roles of developing student motivation and helping students meet high academic standards.

Japanese society places high value on harmony in interpersonal relations and prizes group goals above individual interests. Groupism, which calls for each member of a group to be held responsible for the actions of all others in the group, was introduced in ancient times and still has a strong effect on contemporary Japanese schools. Classroom activities are structured to encourage or require participation in group activities, emphasizing the responsibility of individual students to the class and the school, and to develop group loyalty. In Japanese classrooms, group cohesion and a strong group spirit are fostered. Considerable mutual assistance and adoption of individual views and interests to group goals and standards of behavior are required. The heavy emphasis on group activities and social consensus results in considerable conformity in behavior. There is a strong tradition of viewing conformity and group orientation as demonstrations of moral character.

Also, the Japanese believe that hard work, diligence, and perseverance yield success in education as well as in other aspects of life. A certain amount of difficulty and hardship is believed to strengthen student character and resolve. The amount of time and effort spent on study is believed to be more important than intelligence in determining educational outcomes. In a study of 1,500 first and fifth grade children and their mothers and teachers in Taiwan, Japan and the United States, Stevenson and Lee (1990) found that the Chinese and Japanese societies believe that differences among individuals are primarily a result of life experiences rather than natural differences, and that effort is the major avenue for improvement and accomplishment. In contrast, American mothers place greater emphasis on children's innate ability. Chinese children hold strong beliefs about the importance of effort, American children give greater emphasis to the role of ability, and Japanese children stress both.

In the modern Japanese system, two important assumptions underlie educational practices. One is that virtually all children have the potential to master the challenging academic curriculum, provided they work hard and long enough. The second is that certain habits and characteristics, such as diligence and attention to details, can be taught. The premise is that all children have equal potential. Differences in student achievement are thought to result largely from effort, perseverance, and self-discipline, not from differences in individual ability. Hence, students in elementary and secondary schools are not grouped according to ability. By contrast, in the American education system, ability grouping starts early in elementary school.

Education Structure

Unlike the decentralized American education system, Japan has a centralized three-tiered structure for educational governance and administration. The three tiers -- national, prefectural and municipal -- are all under the general supervision of the National Ministry of Education, Science and Culture. The Ministry exercises a considerable measure of national authority over the entire official system of education. At the elementary and secondary levels, the Ministry prescribes curricula, standards and requirements; approves textbooks; provides guidance and financial assistance to the prefectures and municipalities; regulates the establishment of private schools; and investigates and issues directives to local boards of education for corrective action. The Japanese educational system is characterized by a high degree of uniformity. In fact, the American value of equality of education opportunity may have been carried to the extreme in Japan. This is reflected by the fact that all students in the same grade study essentially the same material at approximately the same time and pace throughout the country. Schools throughout Japan have similar funding, finances, facilities, standards and pedagogy.

The structure of the official Japanese education system is summarized in Figure 1. As mentioned previously, the Japanese education system follows the American 6-3-3 grade system. Compulsory education in Japan is the same length as that in many American states from age six to 15, and it is free.

Preschools: There are two types of preschools: kindergarten and day nurseries. Kindergartens admit three, four and five-year-olds and provide one- to three-year courses of education. The day nurseries cater to infants aged 0-5, inclusive of those in need of institutional care. Children aged three or more are given similar instruction to that available in kindergarten. Preschools aim at helping preschool children develop their minds and bodies by providing a sound educational environment. This academic development includes the first stage of reading and simple arithmetic. The majority of the kindergartens (77 percent) are privately controlled and fee-paying institutions. In a study of Japanese and American preschoolers, Tobin and others (1989) reported that 95 percent of four year-olds in Tokyo are enrolled in nursery schools or day care centers as opposed to 65 percent of four year-olds in New York City. Nationally, 64 percent of the same age group are enrolled in kindergartens in Japan.

Elementary and lower secondary schools: Practically all children aged six to 12 are enrolled in elementary and lower secondary schools. At the elementary school level, 99.5 percent of Japanese children attend public institutions. The small number of private schools are nearly all "university schools," which are academically strong. There is considerable competition to get into these schools. At the junior high school level, the vast majority of students still attend public schools, with only three percent of the students attending private schools.

During compulsory schooling, most Japanese children are automatically promoted to the next grade, regardless of academic achievement. The Japanese believe that all normal children can learn if they are self-disciplined, exert the effort, and persevere. Japanese education avoids making distinctions between students on the basis of ability or achievement. There are no separate tracks, ability groupings, remedial programs, or elective courses in the first nine years of schooling. Students are almost never retained in grade or skipped a grade.

Upper secondary schools: Educational uniformity diminishes beyond compulsory schooling. At the upper secondary school level, the Japanese education system moves from heterogeneous grouping to an ability-differentiated homogeneous grouping and tracking. The particular high school that students enter will influence their college choice and their future career. Stronger academic high schools are more a downward extension of higher education concerns than an upward extension of compulsory school philosophy. In both academic and vocational programs, the content and pace of instruction are geared to covering large quantities of factual information likely to be included on entrance examinations. Both vocational and college preparatory programs are academically oriented and maintain a challenging pace through the introduction of new materials.

All high schools are hierarchically ranked by academic merit. The hierarchical ranking of senior high schools is more important in Japan than it is in any other country. The major criterion for assessing a school's academic merit is the success of its students in being admitted to the University of Tokyo and a dozen or so of other highly ranked universities. In Japan, it is vital to enter a good senior high school as the first step to a good national university, and then to an important position in adult life. Therefore, students between the ages of 12 and 14 work hard to prepare for the entrance examination for senior high schools.

Although compulsory education ends with the completion of junior high school, 94 percent of the Japanese children continue to upper secondary schools in 1989. Among those who go to upper secondary schools, 95 percent are enrolled in full-time programs, others go to part-time or correspondence schools, special training institutions or part-time upper secondary schools. Full-time programs take three years and part-time and correspondence courses take four years to complete. Those students who complete lower secondary schools must formally apply and pass rigorous examinations to advance to upper secondary schools. Only the best students get into public high schools; the others enroll in private ones. Both types of schools charge tuition. An average family spends about five percent of its gross income on a child's public high school education; private schools cost twice as much. (Leestma and Others, 1987)

At the upper secondary school level, 72 percent of all eligible students attend public high schools, and 28 percent private schools. All high school students are enrolled in either general (academic) or vocational (specialized) programs. The general program is the college preparatory track, encompassing two-thirds of the high school student population. The noncollege bound students attend vocational high schools, technical colleges or special training schools. In 1988, 75 percent of the all courses offered in upper secondary schools were general courses and 25 percent were specialized courses. (NIER, 1990) In 1988, a new type of school called "credit-system upper secondary school" was introduced to offer a unique type of part-time or correspondence course to students with special needs. Jobs are guaranteed for vocational track students. School-based employment services play a significant role in matching noncollege bound graduates with available jobs. The graduation rate of upper secondary schools is 95 percent.

Special schools for the handicapped: There are special schools for individuals who are visually or hearing impaired as well as schools for those with other handicapping conditions. These schools offer elementary and lower secondary education to handicapped students. Some schools also offer kindergarten and upper secondary education.

Higher education institutions: There are five types of postsecondary institutions: universities, junior colleges, colleges of technology, special training schools, and miscellaneous schools. Private institutions play a substantial role at the higher educational level. In fact, 75 percent of the universities, 91 percent of the junior colleges, 94 percent of the special training schools, and 32 percent of the graduate schools are private. In 1989, approximately 32 percent of youth 18 to 21 is enrolled in postsecondary institutions. Among those who go on to postsecondary education, 64 percent are enrolled in universities, 13 percent in junior colleges, and 14 percent in special training schools. (NIER, 1990)

The **universities**, led by the national public universities, sit at the top of the hierarchy of the postsecondary system. Universities require the completion of upper secondary schooling for admission and offer at least a four-year course (six-year courses in medicine and dentistry) leading to the bachelor's degree. More than half of the universities have graduate programs and two-thirds of these offer both two-year master's and four-year doctoral programs. In Japan, public universities enjoy better reputations than the private ones. All higher education institutions charge for tuition. Fees in public universities are moderate and financial support is available to students. Entrance to public universities is based on merit, rather than the ability to pay, and they are open to all students who are able to pass their rigorous entrance requirements.

The highly ranked universities, such as Tokyo, Kyoto and Tokyo Institute of Technology, provide passage to good positions in government and large corporations. In addition, the entrance examinations for these institutions mold most of the secondary education. Approximately 64 percent of the students in postsecondary education are enrolled in universities. However, only one quarter of the enrollment are women.

Junior colleges are the postsecondary institutions that women attend almost exclusively; 91 percent of junior college enrollment is women. Junior colleges aim at conducting education and research in specialized subjects, and at developing in students such abilities as are required for vocational or practical life. They provide two- or three-year programs in different fields of study, most of which are designed for women, i.e., humanities, social sciences and home economics. Although credits earned from junior colleges may count toward the bachelor's degree, less than five percent of junior college graduates pursue additional education. (Leestma and Others, 1987)

Colleges of technology produce skilled technicians for industry. Ninety-three percent of these institutions are public institutions. Students are admitted in the 10th grade after completing compulsory education. These institutions offer five-year programs for the training of semiprofessionals. A college of technology usually offers several courses in engineering and mercantile marine studies. Approximately 94 percent of the students in these institutions are men.

Special training and miscellaneous schools are institutions which help students develop abilities for their vocational and daily life, and also help improve their general education. They offer a variety of practical vocational and technical programs in response to the diverse demands of people in a changing society. Approximately two-thirds of these institutions offer two-year postsecondary courses to high school graduates; the rest offer three-year courses to lower secondary school graduates. These institutions, of which approximately 90 percent are private, offer a wide range of opportunities for skills acquisition in the fields of engineering, agriculture, medical care, nursing, health, commerce, home economics, and cultural/liberal arts. Many of these courses are closely linked to the student meeting occupational qualifications and certification. About 54 percent of the students enrolled in special training schools are female.

Entrance into higher education institutions, especially the few prestigious national public universities, such as University of Tokyo, is rigorous and highly competitive. In the hierarchical Japanese society, gaining entrance to the most prominent universities is essential to future social and economic status, and offers lifetime advantages. Therefore, the entrance examinations become high stake competitions among students seeking a limited number of places in the most prestigious universities. To enter into the universities, Japanese graduates have to pass a rigorous National Joint Achievement Test as an initial screening mechanism before individual institution examinations. The examination covers five subject areas: mathematics, Japanese, English, natural science, and humanities. These examinations, in the form of multiple-choice and short answer questions, test massive amount of knowledge of facts and problem solving skills. Some institutions admit students based on the common examinations, others, especially the high ranking universities, add their own examinations and interviews. Increasingly, many private institutions (about 20 percent) admit students

based on high school recommendations rather than on examinations: 60 percent of students in junior colleges were admitted via recommendations. (Leestma and Others, 1987)

The competitive university entrance examination system is known for both its positive and negative effects. The negative effect is that the system creates an "examination hell" for students and how well a student does on the entrance examination virtually determines the student's future. The positive side is that the preparation for entrance examinations boosts academic standards and fosters achievement throughout precollegiate education. Because the entrance examinations cover a wide range of knowledge, students preparing for the examination not only master school subjects but also gain a broad knowledge of a variety of fields.

In order to respond to diverse demands for higher education, the Ministry of Education has created a number of universities such as University of the Air. The purpose of these universities is to provide as many people as possible with postsecondary learning opportunities using television, radio and other media.

Teacher Characteristics

Teaching is one of the few lifetime professional career opportunities readily available to women in Japan. While 94 percent of the preschool teachers and 56 percent of the elementary school teachers are women, less than 40 percent of the lower secondary school and technical college teachers, and less than 20 percent of the upper secondary school teachers are women. Only eight percent of the university professors are women.

In general, Japanese teachers receive less formal education and training than American teachers. As of 1986, 67 percent of the elementary school teachers, 81 percent of the teachers in lower secondary schools and 85 percent of upper secondary school teachers held a bachelor's degree. An additional 27 percent of the teachers in elementary school, 16 percent in the lower secondary schools, and 5.1 percent in the upper secondary schools have completed two-year courses beyond upper secondary education. Further, only 0.4 percent of elementary school teachers, 1.3 percent of lower secondary school teachers and six percent of upper secondary school teachers have taken master's or doctoral level courses. (NIER, 1990) In contrast, as of 1986, 99.7 percent of all American teachers had at least a bachelor's degree; 56 percent of high school teachers, 47 percent of the middle school teachers, and 45 percent of the elementary school teachers in the United States had at least a master's degree. (USDOE, 1987)

In Japan, elementary and secondary school teachers must be certified to teach. There are three kinds of teacher certificates: first class, second class, and advanced class. The minimum requirements for an advanced teacher certificate, for example, include a master's degree and 24 credits in teaching or professional subjects; a first class teacher certificate in lower secondary school requires a bachelor's degree and 59 credits in teaching and professional subjects; and a second class teacher certificate requires two years of postsecondary courses and 35 credits in teaching and professional subjects. A regular teaching certificate granted by a prefectural board of education is valid for life in all prefectures. Japanese teachers are tenured after one year compared to the American public school teachers who are tenured after three years. In Japan, teachers are protected by teachers' unions. Once they are hired, it is difficult for schools to fire unqualified teachers.

The Ministry of Education also provides a variety of inservice training programs to upgrade the quality of teachers. Beginning teachers are required to have a period of induction training for one year after their appointment under the supervision of a master teacher.

Finance of Education

The cost of public education in Japan is shared by the national, prefectural, and municipal governments, and augmented at the upper secondary and postsecondary educational levels by tuition from parents. Each government provides support for its own educational activities. The national government provides almost half of the total public expenditures on education. It also provides subsidies for educational purposes to

private institutions, prefectures and municipalities. The national subsidies to prefectures cover half the cost of salaries and allowances of educational personnel at compulsory schools and schools for the disabled; they also cover half the cost of teaching equipment for public compulsory schools and one- half or one-third of the cost of construction of public elementary and secondary schools. Other subsidies include expenditures for national higher education institutions (34 percent), local public school facilities (5.1 percent), and compulsory school textbooks (0.8 percent). The national government also provides subsidies (6.1 percent) for educational purposes to private institutions. In addition to national subsidies, the government designates 32 percent of the income tax, corporation tax and liquor tax as "local allocation tax" grants to prefectural and municipal governments. (NIER, 1990)

Prefectural governments provide funds for prefectural education institutions and services; salaries and allowances of teachers at municipal elementary, lower secondary, and other schools; and subsidies to municipal elementary and lower secondary schools. Municipal governments subsidize educational expenditures for operating municipal elementary and lower secondary schools, and various municipal services in education.

While compulsory education in Japan is free, both public and private high schools charge tuition. According to the latest data from the Japanese Ministry of Education (1990), the annual amount of tuition fees charged for the public upper high schools is ¥88,800 (US $686.77), and ¥238,506 (US $1,844.59) for the private upper high schools (U.S. $1 = ¥129.30/Japanese Yen in February 1992). The annual tuition fees for national public universities are ¥331,638 (US $2,564.87) compared to ¥570,584 (US $4,412.87) for private universities. The large differences between tuition fees in public and private educational institutions can be explained by the amount of national subsidies received. Only six percent of the total national educational budget is distributed to private schools operation. In 1987, the subsidies of national, prefectural, and municipal governments account for 24 percent of private upper high schools and nine percent of the private junior colleges and universities. Private educational institutions are supported mainly by their own reserve. Student tuition fees make up 45 percent of total private upper secondary school income, 62 percent of private junior college income, and 41 percent of private university income. (NIER, 1990)

Equality of Educational Opportunity

Although the Japanese educational system claims equal opportunity for everyone, certain systematic inequalities exist. It has been noted that students from families in the lowest 20 percent income bracket have a one in three chance of attending a university, compared to a nine in 10 chance for those from families from the top 20 percent income bracket. There is also a potentially serious problem of monopolization of the most prestigious universities by children from the highest socioeconomic levels. In fact, four out of every five students at the University of Tokyo come from homes where the father is either a professional or an executive. Few working class youth are represented. Although admission to the leading universities is based on performance in the entrance examinations, some Japanese worry that the related phenomena of elite schools, family tutors, and the best juku (private tutoring schools) are more accessible to affluent families. Special treatment for students from poor families or other disadvantaged groups is not a matter of national policy. (Leestma and Others, 1987)

The 1982 annual average cost (tuition, fees, and living expenses) for attendance at a public university amounted to 25 percent of the average family income; attendance at a private university costs 30 percent of a family's annual income. The public provision of student financial aid is not as extensive in Japan as in the United States. At the university and college level, only nine percent of the students benefit from government loan scholarships. For most families, the cost of providing for postsecondary education is a heavy financial burden. This inevitably limits the chance for children from low income families to seek higher educational opportunities.

Japanese students are increasingly depending on fee-paying private tutoring institutions outside regular school, such as the academic juku (for remedial and enrichment purposes and to keep up

with the demanding school curriculum) and the yobiko (for preparing high school students for university entrance examinations). These institutions are becoming indispensable in countering the disparities between individual differences in academic ability and achievement. By the ninth grade, 47.3 percent of students go to the academic juku for additional educational and social benefits. However, with the increasing cost of the juku services, not all students are able to obtain them. Hence, the juku reinforces inequality in the Japanese educational system.

Finally, opportunities for women in higher education are more limited in Japan than in the United States. Although Japanese women are about as likely as men to enter higher education institutions, their enrollment pattern differs significantly, reflecting societal expectations and occupational realities. For example, women comprise less than 10 percent of the enrollment at the University of Tokyo, the most prestigious university in Japan. On the whole women represent 25 percent of the public university enrollment. On the other hand, women comprise the majority of the enrollment in junior colleges, most majoring in home economics, arts or social sciences. The junior colleges are known for preparing women for eventual marriage and homemaking, rather than for their training for long-term professional employment in business and industry. (Leestma and Others, 1987)

Issues Facing the Education System

The Japanese educational system faces some important issues. While it is well-known for its high school achievement, it is often criticized for the high level of stress it produces in students and their families. A recent international survey of high school students indicated that fewer than a third of the Japanese young people said they enjoyed school compared with three-fourths of American youth. (Cummings, 1991) Dissatisfaction was associated with school bullying, teacher quality, school violence, crammed education and moral education.

The National Council of Educational Reform, a major educational reform body, summarized the crisis in Japanese schools by saying: "Bullying, suicides among school children, dropping out from school, increasing delinquency, violence both at home and school, heated entrance exam races, overemphasis on scholastic ratings, and torture of children by some teachers, are the results of the pathological mechanisms that have become established in Japan's education system." (**Japan Times**, April 24, 1986) The Council maintains that the most important reform needed is to do away with the "uniformity, inflexibility, closedness, and lack of internationality" which is thought to be at the root of education ills in Japan. One member of the Council stated that "Japanese children are beaten into molds by a system that crushes individual expression and creativity. Intense pressure to perform in lower grades leaves young people burned out by the time they reach the college level."

Although Japanese law prohibits corporal punishment in school, physical punishments by teachers are prevalent. Japanese schools have numerous rules which govern student daily behavior from hair style to dress code. These rules are enforced by physical punishment including slapping, beating, kicking and battering. Cases of death as a result of severe corporal punishment are reported in Japanese newspapers. A survey of 272 university students shows that students get punished 23 times on average in their student life. Another survey involving 2,433 students revealed that 78 percent of the students received injuries and one student died. In Schoolland's recent book (1990), cases of death resulting from teacher brutality are reported. However, a 1990 poll by the Japanese Youth Research Institute showed that 55.7 percent of Japanese parents approve of corporal punishment.

Rigidity, conformity, cramming, high pressure, and lack of freedom are other negative factors of the Japanese education system. The Council asserts that the rigid, uniform school programs, excessive controls on students, and other factors prevent sound character formation. It is believed that enforced uniformity of schooling at elementary and secondary levels sti es individuality, creates frustration and contributes to disorder in schools.

The rigidity and conformity were also strongly opposed by Japanese students. One students writes:

"Teachers pound into the students' heads that one acting on his own will be a great nuisance to everyone else. In the end no one can do anything by himself. Also teachers lecture the students to always govern their action by common sense, thus leaving students incapable of thinking and acting differently from other people. Everything is done in groups, like in the military. There is no self, and no individuality to be recognized. After such an education is enforced on students, the younger generation is now labeled the new breed, characterless and unfathomable. Some feel they are murdered by the rein of control, and that they have been turned into sheep with no spirit of resistance." (Schoolland, 1990)

Cramming is another characteristic of the Japanese educational system. "Pass with four, fail with five" is a common phrase among the students, referring to the number of hours of sleep that a student must be limited to in order to pass the national examinations. In order to pass the high school entrance examinations, junior high school students have to study at home starting immediately after school and until 1:00 or 2:00 am with a one-hour break in between. A regular upper secondary school student goes to juku about three hours per week, per subject. Students from very good high schools typically attend juku up to 15 hours per week. The enrollment of junior high students in the juku has increased threefold in the past 10 years, despite rising tuition fees. With a full school schedule and school related activities, such as club activities, homework, and evening and weekend cram schools, children's leisure time is seriously restricted.

The university admission process has also been singled out for reform by the National Council on Educational Reform. The university entrance examination system is believed to hinder personal and intellectual development, and the excessive emphasis on memorization produces a generation of young people who are unable to think independently and creatively. The Council stresses the need to help remedy the ill effects of the excessive competitive university admission which are characterized by an undue emphasis on applicants' standard scores on achievement tests. Although there is a heavy emphasis on academic achievement at the elementary and secondary levels, the urgency for serious academic pursuit drops drastically at the undergraduate level. Once admitted to a university, a student has high assurance of graduation. Hence, students tend to ease off in college during the first two years of general education, spending much of their time on clubs and other activities. A Japanese critic describes Japanese universities as "academic wastelands" and the students attending them as having the intellectual curiosity of "zombies." (Schoolland, 1990)

PURPOSE OF EDUCATION

The U.S. and Japanese educational systems differ in purpose and pace. From the dawn of its modern history, Japan has been determined to use education as a means of building national unity, developing a technically competent labor force, and identifying and educating its future leaders. Today, government policymakers and business leaders alike view the content and quality of public education as central to national cohesion, economic development and international relations.

The American education system, on the other hand, was intended from an early stage to be responsive to local and individual needs. Beginning in early American history, there developed a notion of learning to enhance the efficiency and enjoyment of the individual. Building on this tradition, other American educators have stressed life adjustment, learning at one's own pace, and learning what is personally relevant to the educational process. (Cummings, 1991)

In Japan, academic development and educational achievement become a serious endeavor rather early in the educational cycle, typically from the second half of primary school education. The pace quickens in Japanese education through the high school stage after which it slackens off. The Japanese system assumes that further development will occur once the young person enters the world of work. (Rosenbaum and Kariya, 1989)

In the U.S. system, the pace of academic development is left up to the individual with the expectation that it should at least become intensive at the collegiate level. As Cummings states, "The prevailing view is that high school is a place for personal exploration and social maturation; rigorous academic work can be postponed to the collegiate or graduate level stage when the young person has found himself."

The Japanese government, from the very beginning, established what is called mass-education or production education, with a uniform curriculum, finance and personnel policy, in keeping with Japan's limited resources. Until secondary school, Japanese schools offer standardized curriculum with virtually no electives so that all children gain a solid ground in mathematics and science and that all receive common exposure to moral education. The system assumes that all students are identical and should be treated in an identical manner. There are no special schools for gifted and talented students and there is no tracking of students during compulsory education years. All children are expected to keep up with the progress of the class within the national curriculum. Students of the two extremes, the high achievers and the low achievers, must seek assistance outside the regular school on their own expenses.

In contrast, the American education system follows a principle of extensive choice in accordance with personal needs and development. A typical high school will accommodate students interested in both academic and vocational studies, and within each of these tracks there are numerous combinations of subjects and subject quality levels. A student may elect to pursue advanced placement, honors, ordinary, and remedial level variation of the same subject. The risk of such a wide range of choices, as termed by Goodlad (1984), is that "many students elect frivolous combinations that do not add up to an education, while the economic burden of providing such a diverse program is often staggering." Some main features of the two public systems are summarized in Table 1.

TIME AND EFFORT DEVOTED TO FORMAL AND INFORMAL EDUCATION

Children in Japan spend significantly more time learning both in and outside school. The Japanese culture believes that the amount of time and effort spent in studying is more important than intelligence in determining educational outcomes. The Japanese school year is the longest among the industrialized nations. Compared to the average American school year of 180 days, the Japanese school year has 240 days, including half a day on Saturdays. Within the Japanese school year there are at least 210 instructional days, with the remaining days devoted to field trips and other educational activities.

Researchers (Stevenson, 1983; and Stigler, Lee, Lucker and Stevenson 1982) found that Japanese 10-year-olds spend 33 hours per week in academic work, compared with 20 hours by the American children of the same age group. It was estimated that the Japanese students spend 1,584 hours per year on school work while the American students spend 720 hours per year. It was found that the Japanese children spend more time learning mathematics than the American students (23 percent compared to 17 percent). These statistics do not take into account the differences between American and Japanese students regarding mathematics homework. American six-year-olds spend 79 minutes per week on mathematics homework, while their Japanese peers spend 233 minutes; American 10-year-olds spend 256 minutes per week on mathematics homework while their Japanese counterparts spend 368 minutes.

According to Thomas Juster and Frank Stanford, University of Michigan economists, American-high school students spend precisely one-half the time the Japanese students do in academic studies. Japanese students are engaged in 61 hours per week in school and in doing homework assignments, while the American students consume an average of 30 hours per week in such activities.

Japanese students also consume more time on informal education. Many Japanese children attend juku (cram school) after regular schools to reinforce and enrich school subjects, or prepare for high school and college entrance examinations. Approximately one percent of the Japanese gross national product is spent on informal education.

The juku is increasingly becoming an integral component of the Japanese education system. It is composed of a large and diverse group of private, profit-making tutorial, enrichment, remedial, preparatory and cram schools. The juku provides supplementary instruction for students to keep pace with the demanding school curriculum, helps those who have fallen behind to catch up with school curriculum, and provides assistance for students who prepare for high school and university entrance examinations. Juku participation rates increase with grade level throughout the compulsory education period. The national average attendance rates rise from 6.2 percent in the first grade to 47 percent by the third year in lower secondary school, with higher figures in large urban areas. The juku functions as an academic support institution to counter the disparity between the high and low achievers. It also performs important social functions for young people by providing opportunities for social contacts with peers outside the students' regular school. Typically, children attend the juku two to three evenings a week and on Saturday afternoons. During school holidays, students attend the juku on a full-time basis. Parents have to pay for such schools. In 1985, the average Japanese family with one elementary school child paid an estimated two percent of the family income for juku classes.

CURRICULUM STANDARDS AND IMPLEMENTATION

General Curriculum

The Ministry of Education, Science and Culture establishes the curriculum for elementary and lower secondary schools in Japan. The subjects to be taught and the standard number of yearly school hours to be devoted to each subject are specified in the "Regulations for the Enforcement of the School Education Law." The Ministry also sets forth a list of subjects to be offered in upper secondary school in those regulations. (NIER, 1990) It also issues lists of recommended textbooks from which schools can choose. Thus, there is uniformity of curriculum and textbooks for students of the same grade throughout Japan. The same curricular standards apply to every child in school. Schools do not perform remedial or enriching functions, as these functions are performed by the jukus.

In the United States, on the other hand, decisions on curricular standards and textbooks are made at the school or local level. Curricular standards vary according to student academic progress and ability. In high school, the curriculum is assembled to suit individual interests. Therefore, it can differ from one student to another. Ability tracking or grouping is practiced throughout K-12. Children in the same class are often divided into subgroups of advanced, intermediate, and slow learners. As a result, high school graduates from the same class may obtain different levels of education.

Elementary school curriculum: Japanese and American elementary schools teach similar subjects, except that Japanese schools include one period of moral education per week in both elementary and secondary schools. Japanese elementary subjects include Japanese language, social studies, arithmetic, science, music, art and handicrafts, homemaking, physical education, moral education, and special activities. (Appendix A) According to data from the Japanese Ministry of Education, elementary school students spend an average of 27 percent of their school hours studying Japanese language and 18 percent of their school time on arithmetic. In comparison, American elementary schools devote more time to reading/language arts and significantly less to mathematics than do Japanese elementary schools. As shown in Table 3, the American second graders spent 48 percent of their school time studying English while the Japanese second graders use 36 percent of their time on Japanese language; the American second graders spent 7.6 percent of their time studying mathematics and Japanese spent 16 percent of their time on the same subject. (Japanese Ministry of Education, 1972) By fifth grade, Japanese students spend approximately equal time on studying mathematics and Japanese language, while the American students spend almost three times as much time on reading as they do on mathematics.

Lower secondary school curriculum: In the lower secondary schools, there is a greater emphasis on academic subjects. Education goals and procedures focus more narrowly on the transmission and acquisition of factual knowledge and on the further development of basic skills. By the ninth grade, impending high school entrance examinations impart a sense of urgency for studying. Other than moral education, Japanese lower secondary schools offer similar subjects as do the American middle schools. At the middle school level, Japanese schools spend about equal time on Japanese language, mathematics and science as American schools do. (Appendix B) Foreign language, usually English, is an elective course. In Japan, elective courses are not choices left to the student, but are courses selected by the principal according to prefectural guidelines. Because English is one of the required subjects in the university entrance examination, nearly all lower secondary schools follow a policy of requiring three years of English language instruction.

Upper secondary school curriculum: The Ministry of Education sets guidelines on the subjects and teaching content of the different subjects to be offered in upper secondary schools, and the standard number of credits to be earned by students in each subject. It also lays down the

subjects to be required of students enrolled in general or vocational courses, and additional credit requirements.

Eighty or more credits are required of all students for high school graduation. (Appendix C) One credit consists of 35 class hours (a class hour is 50 minutes). There are 32 credits in required subjects, including Japanese language I, contemporary society, mathematics I, science I, physical education and health, music and art, and home economics (only for girls). Although foreign language is not a required subject, most students take English as an elective. All required courses are taught to students enrolled in academic and vocational programs in the first year of high school.

In 1989, the Ministry of Education published a revised course of study for all four school levels. The revised course of study was put into effect in 1990 for kindergartens, and will be put into effect in 1992 for elementary gradres and lower secondary schools and in 1994 for upper secondary schools (Appendix C).

Mathematics

The Second IEA Mathematics Study provides a unique opportunity to compare the mathematics curriculum standards of the United States and Japan. As shown in Table 4, the American 8th graders performed significantly lower than the Japanese 8th graders in algebra, measurement, and geometry. A comparison of the Japanese and American curricula reveals that Japan's national mathematics curriculum for 8th graders covers markedly more content in algebra and measurement than the U.S. mathematical curriculum at this level. The American 8th grade curriculum focuses mainly on arithmetic, with a sprinkling of algebra and geometry. A complete algebra course is offered to a minority of students. Topics in geometry are taught in the eighth grade in many countries, but only in a few American eighth grade classrooms.

Examination of the mathematics curriculum at the high school senior level reveals that the Japanese curriculum covers markedly more geometry, calculus, and statistics than the American mathematics curriculum at this level. In addition, Japanese schools implement 80 to 100 percent of their intended mathematics curriculum whereas the American high schools only teach 42 to 97 percent of the intended curriculum content. In particular, the American high school seniors' opportunity to learn the tested content areas range from 62 percent in geometry, 42 percent in calculus, and 45 percent in statistics, as compared to 90 percent coverage in geometry and calculus, and 83 percent in statistics by Japanese high schools. It is not surprising that Japanese seniors achieved first and second place in all mathematics content areas in the IEA Mathematics Test, while the American seniors ranked between 10th and 14th among 15 participating countries. American seniors scored poorly, especially, in algebra, geometry and calculus. The percentage of mathematics questions answered correctly by advanced American students was 42 percent in algebra, 32 percent in geometry and 28 percent in calculus, compared to the Japanese sample of 78 percent in algebra, 60 percent in geometry, and 66 percent in calculus.

One reason for the low level of American student achievement in mathematics is the difference in the level of mathematics instruction. In American schools, not all eighth grade students receive the same amount and level of mathematics education. The teacher adjusts and selects the work to suit the ability and experience of individual students or groups of students in the classes by requiring them to do different exercises of different difficulty or requiring different levels of skills. Mathematics students are divided into four types according to students' academic ability: the remedial, typical, enriched, and the algebra levels. The algebra items (32 items) tested in the IEA Mathematics Study, for example, were 37 percent for remedial classes, compared to 86 percent for the algebra classes. However, the algebra classes missed other topics, such as geometry and measurement. The differential treatment of and requirements for students at the eighth grade level apparently lowered the overall achievement of the American sample. Such is not the case in Japan. All Japanese students at this or lower levels are exposed to the same amount and the same level of mathematics content. All students take the same courses and are expected to achieve at similar levels.

There are also differences in mathematics instruction at the twelfth grade level in American schools. American seniors are allowed to take different levels of mathematics courses to satisfy high school graduation requirements. Students taking mathematics classes in the twelfth grade were divided into precalculus and calculus classes. The curriculum coverage for the two types of classes differs considerably. For example, the American sample in the second IEA Mathematics Study consisted of 191 precalculus classes and 19 calculus classes. Students in the precalculus classes were exposed to considerably less mathematics content than those in the calculus classes. Students in the precalculus classes were exposed to only 45 percent of the 46 elementary function and calculus test items in the IEA Mathematics Study. Students in the calculus classes were exposed to 92 percent of the test items. Having been exposed to only 42 percent to 89 percent of the test items, the American sample in the IEA study, which consisted of 80 percent of precalculus classes, was at a distinct disadvantage when compared to their counterparts in other countries. In comparison, all Japanese eighth graders receive the same level of mathematics instruction and are exposed to the same range of mathematics contents. At the end of compulsory education, every student is supposed to have a solid foundation of basic mathematics skills. Japanese students are tracked into science and literature majors from the second year in upper secondary school. Students in science majors take considerably more mathematics than their literature peers. They take six hours of mathematics in the second year and 10 hours in the third year, with five hours in calculus and five hours in probability and statistics. (U.S. Education Department, 1987)

Differences between the American and Japanese educational systems are also found in the proportion of time devoted to mathematics instruction and the availability of qualified mathematics teachers. (Table 5) In American schools, the proportion of time devoted to mathematics instruction at the high school level remains the same in the junior and senior years (14 percent), while in Japan, the proportion of time for mathematics instruction increases from 13 percent for juniors to 20 percent for seniors.

A study was undertaken (Iben, 1988) to determine the similarities and differences between American and Japanese experiences of seventh and eighth grade students in mathematics, and to develop an understanding of why large achievement differences exist between the United States and Japan. Data were gathered from both countries. The Japanese sample was selected from a single middle school in a medium-sized suburban school district; 166 seventh and 40 eighth grade students participated. The American sample consisted of 284 seventh and 265 eighth grade students from three middle schools in medium-sized Midwest school districts. The testing results demonstrated that the mean score of Japanese seventh graders is 35 percent greater than that of the American seventh graders, and that the Japanese eighth graders mean is 11 percent higher than the mean for American eighth graders. Using American educational standards, the means for Japanese seventh and eighth graders are above those of American eighth graders.

The researcher gave several explanations for the differences in achievement. First, space relations is a defined part of the Japanese mathematics curriculum beginning in the first grade. Second, Japanese students entering the seventh grade have the equivalent of 2.4 school years more mathematics instruction than do their American peers. This is equivalent to 40 percent more school time spent on the study of mathematics. Third, in Japan, the study of geometric figures begins with developing student spatial understanding of relationships of lines, angles, and enclosed figures. Teachers used the Socratic method of inquiry to develop the student's ability to describe and compare geometric figures orally. For most American students, geometry does not appear in the mathematics curriculum until eighth grade and is generally taught as a continuation of computation, measurement and memorization of formulae.

Further, the IEA Mathematics Study (1989) indicates that the Japanese curricula move faster in mathematics and science than the American curricula. For example, Japanese children are introduced to many concepts such as decimals, fractions, and geometric figures earlier than their American counterparts. Accuracy in computation is stressed more than the ability to estimate. More

emphasis is placed on geometry, ratios, proportions, and reading charts than in most American elementary schools. Algebra is introduced to all seventh graders in Japan, whereas it is taught later in American mathematics curricula. By the end of the compulsory education, all Japanese students have studied algebra through the factoring and plotting of quadratic equations and the geometry of circles, the Pythagorean theorem, and some basic solid geometry. In comparison, the American middle school mathematics is primarily a review of arithmetic. A comparative assessment in mathematics at the eighth grade will catch young people of the two systems at different stages in their intellectual development; the test will favor the Japanese over the Americans.

Science

Japan stresses science education for all its people while in the United States, science education has been on the decline, with fewer and fewer high school students taking science courses beyond the 10th grade. (National Science Foundation, 1981) Japanese upper secondary school students must earn 22 credits (one credit consists of 35 class hours) in science I and II, physics, chemistry, biology, and earth science to graduate. The American high schools, on the other hand, generally require two years of science courses to graduate. As shown in Table 6, six percent of the age group (high school seniors) are enrolled in biology, one percent in chemistry and physics, compared to 12 percent of that age group in Japan enrolled in biology, 16 percent in chemistry and 11 percent in physics.

The Second IEA Science Study indicates that the overall science achievement of Japanese 10-year-olds ranked first among 17 industrial countries, while the American 10-year-olds ranked eighth; the Japanese 14-year-olds ranked seventh compared to the American 14-year-olds who ranked fourteenth. At the high school senior level, Japan ranked fourth in chemistry and physics out of 13 countries and tenth in biology, while the American sample ranked last in biology, eleventh in chemistry, and ninth in physics out of 13 countries. (Table 7)

An examination of the curriculum coverage for the three age groups in the two systems reveals no apparent disadvantage for the American sample as was the case in the IEA mathematics tests. In fact, in American schools at the elementary and junior high school levels, a higher percentage of curriculum was covered than in the Japanese schools. The reported curriculum covered at the senior level in American schools was 100 percent for all three science areas. However, 38 percent of the American elementary schools and 30 percent of the junior high schools in the IEA sample scored lower than the lowest scoring schools in highest scoring countries in general science achievement, while practically no Japanese schools at these levels in the IEA sample were in that category.

Regarding time spent on specific curricular areas, 27 percent of the total primary school curriculum and 23 percent of the junior high school curriculum in Japan are devoted to science and mathematics; at the senior high school level, students take 1 1/4 science courses per year in three years of high school. The time devoted to science instruction at the elementary level is about the same in both systems. (Table 8) Japanese high schools, however, devote more time to science instruction (140 hours per year) than do American high schools (108 hours per year). In the last two years of high school, Japanese science majors take eight hours of science per week (280 hours per year). Science courses are mandatory in Japan from grades one to nine. At the upper secondary level, considerably more Japanese high school students take more science courses than do their American counterparts, especially in upper secondary schools. (Jacobson, and others, 1986) At the upper secondary level, the average Japanese literature major takes three hours of science per week, while the average Japanese science major takes eight hours per week. Science is required of all Japanese students at every grade level, whereas in the American high schools students can elect to pursue different subjects. The years of science taken by students who graduate from American high schools differs with the curricula pursued. Of those who pursue academic curricula (college-bound), 74 percent take two years of science courses and 55 percent take three. Accordingly, upon graduation from high school, Japanese students will have had approximately three times as many class hours of

science as American students who elect to take three years of science in high school. (Hurd, 1982)

In Japan, the science and mathematics curricula are typically integrated, while in the U.S. they are typically taught as separate subjects. For example, Japanese advanced physics courses presuppose calculus. In addition, advanced high school science courses in Japan resemble college courses in the United States in terms of mathematics sophistication and topical coverage. (Troost, 1984)

The two countries also differ significantly in the study of science. In the Japanese system, several core science subjects are studied and restudied at successive grade levels with increasing sophistication and detail. Scientific observation, laboratory experiments and field work are part of the science curriculum at all levels. In the United States, on the other hand, the study of science subjects follows a progressive approach, one science subject is studied intensely within one year and is never restudied. For example, high school students usually study biology in 10th grade, chemistry in 11th grade and physics in 12th grade.

MOTIVATION FOR EDUCATIONAL ACHIEVEMENT

There are two powerful incentives for educational achievement in Japan. The first incentive is the examination taken by virtually all Japanese children for entry to the hierarchically ranked high schools. The second and more important incentive for many Japanese students is the rigorous university entrance examination. In Japan, one in five high school students actually continues his/her education in a four-year university. In Japan, university graduates have a lifetime advantage over those without a university degree. Graduation from a highly ranked university determines initial employment with more prestigious companies and remains a major consideration for advancement.

University entrance examinations in Japan are principally based on the high school curriculum. Admission to universities and colleges is awarded only to those who have acquired a thorough knowledge of the principal curricular areas. However, mastery of the high school curriculum may not be sufficient to pass the very difficult entrance examinations to top universities. Helping fill the gap between what the students learn in high schools and what they must know to pass the examinations of a specific institution is a sizable number of private cram schools called the Yobiko. Yobiko is the extension of the juku system for lower grades. The participation in Yobiko has increasingly become a necessity for college bound students.

In contrast, there are no such competitive national examinations in the United States. Only a few dozen colleges are highly selective. Therefore, for many American high school students, doing well in high school and taking more challenging courses, have little to do with college admission or future job opportunities.

CLASSROOM ORGANIZATION

In their extensive observational study, Stevenson and Lee (1990) found that class time was spent more efficiently and in a more productive way in Japanese and Chinese schools than in American schools. Also, Japanese and Chinese teachers were more energetic and innovative; lessons were well organized and captured the children's attention, and homework assignments were thoughtfully planned.

In characterizing mathematics classes in Japan and China, Stigler and Stevenson (1991) described the lessons as coherent, and presented in a thoughtful, relaxed, and nonauthoritarian manner. In addition, "teachers frequently rely on students as sources of information. Contrary to the stereotyping perception that Japanese classes tend to focus on rote learning, the researchers found that the lessons are oriented toward problem solving rather than rote mastery of facts and procedures and utilize many different types of representational materials. The role assumed by the teachers is that of a knowledgeable guide, rather than that of a prime dispenser of information and an arbiter of what is correct. There is frequent verbal interaction in the classroom as the teacher attempts to stimulate students to produce, explain, and evaluate solutions to problems."

In Asian mathematics classes, Stigler and Stevenson found that lessons almost always begin with a practical problem or a word problem. The teacher leads the children to recognize what is known and what is unknown, and directs the students' attention to the critical parts of the problem. Teachers are careful to see that the problem is understood by all children. Even mechanics, such as mathematical computations, are presented in the context of solving problems. It is not uncommon for the Asian teacher to organize the entire lesson around the solution for a single problem. Before ending the lesson, the teacher reviews what has been learned and relates it to the problem posed at the beginning of the lesson.

Although the average number of students in a Japanese class is significantly greater than the number in an average American class (approximately 40 students in Japan as compared to 20 students in the United States), Japanese students receive much more instruction from their teachers than American students. (Table 9) While Japanese students spend the majority of their time working, watching, and listening together as a class and are rarely divided into small groups, American children, by contrast, spend the majority of their time working on their own and a smaller amount of time on activities as a member of the whole class. American teachers spend more time working with individuals and less time working with the whole class than do the Japanese teachers.

For instance, 74 percent of the time Japanese mathematics classes were led by teachers, as opposed to 46 percent of the time in the United States. Even the American first graders actually spent more time on their own than they did participating in teacher-led activities. The researchers also found that no one was leading instruction 21 percent of the time in Japanese classrooms and 51 percent of the time in the American classrooms. In addition, much of the time when American teachers were working with the students, they were working with individuals or small groups, rather than the whole class. American teachers spend more time in transition, such as discussion of homework and announcements, and less time on academic activities, and spend much of their time working with individual students and attending to matters of discipline. American students spend more time working on their own and less time being instructed by the teacher. Coherence is also disrupted when teachers shift frequently from one topic to another to capture children's interest. These differences in classroom organization mean that American students spend much less time in school being instructed to by the teacher. (Stigler and Stevenson, 1991) Also, Japanese teachers spent 10-20 percent of the time keeping order, while in the United States around 40 percent of the time was devoted to this activity. (Cummings,

1980) In regard to teaching styles, Chinese classrooms are more performance oriented, Japanese classrooms are more reflective, and American classrooms are not as reflective as the Japanese classrooms, nor do they place a consistent emphasis on performance as do the Chinese classrooms. The amount of verbal explanation, both by teachers and students, varied from 47 percent in Japanese classrooms to 20 percent in American classrooms in the first grade, and increased to 51 percent and 38 percent respectively, by the fifth grade in the two countries. Japanese teachers emphasize thinking and verbalization through problem solving. Stevenson and Lee concluded that greater time on tasks is not the primary basis for the high achievement of Japanese and Chinese children. The answer lies instead in the high quality of experiences that fill the instructional time.

PARENTAL ROLE IN EDUCATION

The responsibility of educating children in Japan is shared among the school, parents and the community. Parents, especially the mother, and children take education seriously because success in school is a crucial determinant of economic and social status in adult life. The role of home and family in a child's education, both before the child enters school and throughout the school years, is a fundamental principle of Japanese society. Japanese families are stable, with a divorce rate in 1980 of 1.2 per one thousand inhabitants, while the comparable figure for the United States was 5.2. Just six percent of Japanese families are headed by a single parent. (Leestma and Others, 1987)

A close observer of the Japanese society states that "the anxiety of Japanese parents for the cognitive achievement of their children easily outdistances that of American parents," and that "Japanese men in looking for a wife give a high rating to devotion to children's education." (Cummings, 1980) Both husband and wife generally share a belief that the children are at the center of their marriage. Thus, the education of children becomes an important family function.

In the traditional Japanese family, the husband focuses on the work place and extended work-related socializing in the evening, and the mother has responsibility for the upbringing and the education of the children. Although the educational level attained by Japanese mothers is considerably lower than that of the American mothers (Table 10), they take the responsibility for their children's education very seriously. As shown in Table 10, 53.0 percent of American mothers received postsecondary (tertiary) level education, whereas only 12.0 percent of Japanese mothers attain such an educational level. (Robitaille and Garden, 1989)

Much of a Japanese mother's sense of accomplishment is tied to the educational achievement of her children. She puts a lot of effort into helping her children with school work, making sure that her children invest enough hours studying for school. In addition, there is considerable peer pressure on the mother. A woman's success as a mother, as perceived by the community, depends in large part on how well her children do in school. Mothers are expected to attend PTA meetings. The PTA functions as a forum for the school to explain its policies and expectations for parents, and to organize parental assistance for school activities. Most Japanese mothers work with their children on a daily basis, helping them with homework or drilling them on lessons to be learned. Ninety-eight percent of all elementary school children have their own desks in designated study areas at home.

The extent to which parents buy their children supplemental educational texts and desks to work at home has been cited as being indicative of parental concern for their children's educational achievement. In a 1983 study, Stevenson found that 98 percent of Japanese 10 year-olds had their own desk at home compared to 63 percent of their American counterparts. In addition, 58 percent of Japanese parents bought their children mathematics workbooks for home study as opposed to 18 percent of American parents. According to their own descriptions, Japanese mothers help their children with homework on an average of 24 minutes a day for six year-olds and 19 minutes a day for 10 year-olds.

SOCIAL STATUS AND ECONOMIC REWARDS FOR TEACHERS

Japanese society entrusts a major responsibility for the education of children to teachers and expects a great deal from them. It confers high social status and economic rewards, and subjects teachers to constant public scrutiny.

According to a 1975 survey of social stratification and social mobility in Japan, out of 82 occupations, elementary school principals and teachers ranked ninth and 18th, respectively, in public esteem. Elementary school teachers enjoy higher prestige than civil and mechanical engineers, white collar employees in large firms, and municipal department heads. University professors were ranked third, below court judges and presidents of large companies, but above physicians. First-year teacher salaries are higher than those of other professions, such as private industry executives, engineers, pharmacists, etc. At mid-career, their salaries are approximately at the same level.

The average salaries of Japanese ($20,775) and American ($21,476) teachers were nearly equal in purchasing power (Table 11) during 1983 to 1984. (Barro & Lee, 1986) Teachers' salaries in Japan are more linked to seniority than they are in the United States. A Japanese teacher with a four-year degree at the top of the seniority scale earns three times as much as an entering teacher, compared to less than twice as much for a United States counterpart. The pay scale for Japanese teachers has up to 39 annual steps. While the salaries of recently hired Japanese teachers are 20 to 25 percent lower than those of entering teachers in the United States, the salaries of senior Japanese teachers are substantially higher -- by 30 to 40 percent -- than those of their equally experienced American counterparts. After 35 years of teaching, the Japanese teachers' relative salary advantage is in the range of 80 to 100 percent above their American colleagues. The incentive to remain in the profession is strong because of the cumulative effect of seniority and generous retirement benefits.

Japanese teachers' salaries are substantially higher relative to national indicators of per capita economic activity than are teachers' salaries in the United States. The average teacher's salary in Japan was 2.4 times as great as that country's per capita income in 1983, compared to 1.7 times per capita in the United States; and, 3.4 times as great as per capita consumption in Japan, as compared to 2.3 times per capita consumption in the United States. This means that the average Japanese teacher's salary buys a significantly larger share of the nation's goods and services than does the average teacher's salary in the United States. (Barro & Lee, 1986)

EDUCATIONAL EXPENDITURES

According to data from the Japanese National Institute for Educational Research (1990), the total public expenditures for education in Japan (1987) amounted to ¥16,901 billion, or 6.4 percent of the national income, and 18.2 percent of the net total of national and local government expenditures. The proportion of national government expenditures spent on education was 9.2 percent, and the average proportion of local government expenditures devoted to education was 22.5 percent. More than 40 percent of the total public expenditures for education are shared by the national government. Among the total public expenditures for education, 70.7 percent are spent on preschool through upper secondary school, 19.3 percent on higher education and education of adults and youth; and 10 percent on educational administration.

Two recent international comparison studies on educational expenditures in selected industrialized nations reported different outcomes, as a result of using different measures of educational expenditures. (Table 12) Using the Purchasing Power Parity (PPP) index, the Hudson Institute (1990) reported the per student instructional expenditure for prekindergarten through 12 for the United States as well above that of Japan. The PPP index measures the number of U.S. dollars needed in each country to buy the same number of fixed goods and services costing $100 in the United States. In 1985, the index indicated that, on the average, the United States spent $3,310 per student, ranking second among the 22 industrial nations, while Japan spent $1,805 per student, ranking 15th. (Perelman, 1990) The Hudson Institute report concluded that the restructuring of American education may not necessarily require additional spending, but different priorities.

A different view is presented by the Economic Policy Institute (1990). Comparing education expenditures expressed as a percentage of the Gross Domestic Product (GDP), the Institute argues that although the public education spending in the United States is 6.8 percent of its GDP, ranking second among 16 industrialized countries, the United States spends 4.1 percent of its GDP on K-12 education, ranking 12th. Japan, on the other hand, spends 4.8 percent of its GDP on K-12 education, ranking sixth among the 16 industrialized countries. However, while the Institute advocates for increased education spending, it recognizes that money does not guarantee excellence, and more money is not the only answer to the difficult problems of revitalizing primary and secondary education in the United States.

JAPAN'S EDUCATION REFORM

In response to the rapid changes in the social environment and the expansion of education, and such problems as poor discipline among school children, the intense competition for entrance to universities and the excessive uniformity of the content and methods of school instruction, Japan has taken serious steps in reforming its education system since 1984. During its three-year mission, the National Council of Educational Reform, an advisory body to the Prime Minister, issued a series of four reports, diagnosing the education problems and making reform recommendations. The Council recommended reforms in the following fundamental issues:

1. Transition to a lifelong learning system

- The role of formal education in lifelong learning
- Promotion of active learning activities
- Development of an infrastructure for lifelong learning
- Promotion of lifelong sporting activities
- A consultative committee for the promotion of sports

2. Reforms of elementary and secondary education

- Enrichment of moral education
- Basic direction for the improvement of the content of instruction
- A new system for textbook authorization
- Creation of in-service training programs for beginning teachers
- Introduction of new types of secondary school (credit-system schools)

3. Reform of higher education

- Reform of the procedures for selecting university entrants
- Liberalizing, and giving more flexibility to, the qualifications for university entrance
- Individualization of institutions of higher education
- Promotion of basic research in universities
- Drastic improvement and reform of graduate schools
- Strengthening of cooperation between universities and society
- Establishment of a National Council of Universities and Colleges
- Appointment of university teachers

4. Reforms for coping with internationalization

- Establishment of new international schools
- Improving and reenforcing the mechanisms for accepting foreign students
- Review of foreign language education
- Enrichment of the teaching of Japanese to foreigners

5. Reforms for coping with the information age

- Creation of new systems of teaching and learning relevant to the information-oriented society
- Utilization of information media in elementary and secondary education and the education of adults and out-of-school youths.

6. Reform of educational administration and finance.

- Local boards of education: fulfilling and revitalizing their role
- More rationalized and more efficient educational finance
- Reorganization of the Ministry of Education, Science and Culture

In 1987, the Ministry of Education, Science, and Culture created a Ministry Headquarters for the implementation of Educational Reform headed by its Minister. Since then, many reform measures have been implemented. For example, to ensure the transition to a lifetime learning system, the Ministry has been striving to facilitate the use of formal education facilities as places of learning for adults by offering extension courses at upper secondary schools and universities, and by making the physical facilities for formal education available to community use. In addition, closer relationships

between schools and communities are encouraged.

To improve the quality of teachers, a system of induction training for beginning teachers was introduced in 1989. Under this system all beginning teachers employed at national and local public schools are required to have a period of induction training for one year after their appointment. During this period, a beginning teacher will be under the supervision of a master teacher, and part of his/her training will be given in a prefectural education center. In addition, all teachers who have served for five years or so are provided with some in-service training. Some training programs, as well as programs for study tours overseas, are offered to school principals and experienced teachers.

Reform measures to improve the existing procedures for selecting university entrants have also been implemented. In 1990, the Ministry introduced a new national examination administered by the National Center for University Entrance Examination. The testing subjects required of university applicants are determined by individual institutions. The main purpose of this examination is to assess the level of the applicant's basic academic achievements obtained in their upper secondary schools. Individual universities are expected to make an overall evaluation of applicants' ability on the basis of the results of this examination, as well as school reports, interviews, essay tests, achievement tests, practical skills tests, etc. Thus, the new selection procedures assess the applicants' diverse abilities and aptitudes suited to receiving a university education.

POLICY IMPLICATIONS FOR THE AMERICAN EDUCATION SYSTEM

While recognizing the differences in social, cultural, and educational functions between the two countries, the relative success of the Japanese education system has several important policy implications for American schools.

First and foremost, the Japanese education experience suggests that high educational standards can be achieved by devoting sufficient time and effort. There is no magic about the Japanese schools. Japanese students attend school considerably longer than American students and spend substantially more time in and outside of school studying, reviewing, reinforcing, remediating and enriching school subjects than the our students. As described by Taylor (1991), deputy executive director of the National Assessment Governing Board, American schools still follow "a half-time schedule that usually can produce only half-baked students" at a time when the changing nature of the world requires full-time study to develop fully educated citizens. More important than the total time available for formal schooling is the intensity of schooling. Greater efficiency within the existing school day and school calendar should be achieved. He emphasizes that parents, policymakers, and teachers ought to do one of two things: increase the amount of time students spend actively engaged in learning, in school and out, or quit complaining about how poorly American students perform when compared with their counterparts around the world. Without the time and the intensity with which American students are actively engaged in learning, it is not fair or wise to expect our students to achieve at the level of performance that the Japanese students do.

Second, the Japanese education experience shows that a high level of academic achievement is possible for all children or a majority of the children, not just for the brightest ones, if high expectations are placed on all children. A challenging and standard curriculum for all students during the compulsory education years is one of the key contributors to a solid foundation in basic education in Japan. The success of Japanese education appears to indicate that it may be possible to deliver the same challenging curriculum to all children and expect all children to keep up with the school curriculum during the compulsory education period. A high level of achievement is not reached easily. Children, especially the slower children, need to make extra efforts and spend extra time in and outside school. By contrast, the American schools' practice of early ability tracking fails to deliver the full regular school curriculum to all children. In addition, ability-groupings may have a negative impact on students' self-esteem and educational aspirations. Early ability tracking of one type or another deprives the "low learners" of the opportunity to be exposed to the grade level academic content, therefore, lowering their chances to succeed in school and in later life.

The third implication is that parents can contribute significantly to their children's education. Parental concern and involvement in the education of their children can make a big difference in how much and how well children learn and achieve. Japanese families do their best in instilling their youngsters with the attitudes and habits that children need for formal and informal schooling. Once school starts, Japanese parents, especially the mothers, stay in touch with teachers, supervise homework, arrange extra instructional help if needed, and buttress the child's motivation to do well in school and beyond. The Japanese experience underscores that education is a shared responsibility of the school and home.

Fourth, the Japanese education experience implies that a challenging school program is the basis for a high level of school achievement. All Japanese students are expected to achieve a level of performance that is truer to their intellectual level than are most American students. Japanese schools elicit more from students and believe that children learn more when more is expected of them. Compared to the Japanese school curriculum, the American curricular standards, especially in mathematics and science, lack the level of difficulty and complexity at comparable grade levels. American curricular standards need to be reviewed and matched with high achieving countries if we expect our children to achieve world-class standards.

Fifth, motivation and incentives are important factors in children's academic pursuit and school achievement. In the Japanese society, there is continuing emphasis on awakening in students the desire to try, the conviction that progress can be made by practically anyone who tries hard enough, and the realization that adults genuinely care about one's performance. Also, school achievement is closely tied to students' future employment and schooling. In particular, the Japanese examination system has provided the single most important motivation for serious academic pursuit for Japanese children. In the American educational system, the motivation for high achievement is not as strong or as focused. American school curricula and examinations often provide challenge to a small number of students but do not challenge the majority. They often test minimum competency instead of maximum mastery. At the high school level, only college bound students are usually motivated to take a more challenging curricula. For students not planning to go to college, the impetus to study is almost nonexistent. If job opportunities and admission to the university were more closely related to the level of high school achievement, American students would probably be better motivated to study in school, and the country would probably have a better educated work force.

Finally, the Japanese education system demonstrates that a high level of school achievement does not have to be costly. By the standards of developed countries, Japanese schools are much less equipped than American schools, spend no money on remedial education and gifted education, and much less on administrative personnel. Two of every five members of the school staff in the U.S. do not teach, while less than one of every five do not teach in Japan. Clearly, a larger proportion of U.S. expenditures go for the services that bring resources to the classroom while a larger proportion of the Japanese expenditures are for the activity that takes place in the classroom. Much of the government effort in the United States to raise educational standards has consisted of increasing public expenditures on education.

CONCLUSION

The comparison of the American and Japanese educational systems reveals that the two systems differ in educational structure, educational purpose, amount of time spent on intensity of formal and informal schooling, curriculum standards, expectations for children's achievement, motivation for academic achievement, efforts made by children in learning and achieving, and educational expenditures.

The Japanese educational system is highly centralized, fosters uniformity of standards and achievement, and emphasizes the mastery of school curriculum by all children. Under this system, serious academic development is stressed from an early age; the intensity of schooling is maintained at a high level and increases in the high school years; the competitive high school and university entrance examinations provide motivation, incentive and urgency for Japanese children to study and learn the school curriculum to the best of their ability; and effort and perseverance are viewed as more important than innate ability or aptitude for school achievement. There is also a deep belief by schools, parents and children that all children but the seriously disabled, can master the school curriculum provided that they are willing to make the effort. All of these characteristics have contributed to the high level of academic achievement by Japanese children.

American schools, on the other hand, are more sensitive to individual academic ability and do a better job than the Japanese schools in meeting individual and diverse needs of children, and in encouraging students' creativity. American schools are less stressful and provide a more pleasant learning environment for children. Schools and teachers enjoy more autonomy and freedom in deciding curriculum content and standards. The ideal of the American educational system is to be responsive to individuals' needs. Consequently, children going through the same education system can acquire a completely different level of education.

The Japanese education system seems to serve its national interest and works efficiently for its country in providing universal basic education to all of its children and producing a broadly literate population and work force. Its education system has undoubtedly contributed to the strength of Japan's competitive economy. It has demonstrated that its high level of success is not the result of better educational resources, more qualified teachers, higher per-pupil expenditure, or a smaller class size. Its achievements are the result of valuing learning and achievement, discipline in academic pursuit, rigorous school curriculum requirements, high standards and expectations for all children, intensity of schooling, well organized classes, more time and effort devoted to learning, diligent work by the children, and deep commitment and involvement by the family.

The Japanese educational system is not perfect. In response to national concern, major education reforms have taken place in Japan since 1984. Japan's major reform policies include providing lifelong education opportunities by offering extension courses at upper secondary schools and universities, and by making physical facilities for formal education available for community use; enriching and improving elementary and secondary education through upgrading the quality of teachers, improving the conditions of the educational environment, giving upper secondary school more diversity and flexibility, and encouraging the establishment of a "credit system" in the upper secondary schools; individualizing and enhancing the activities of institutions of higher education and reforming the system of university entrance examinations; promoting science research by increasing grants-in-aids to researchers; coping positively with an internationalization trend through a wide range of measures for meeting the real needs of these foreign students; and, coping with the information age by developing information literacy both in school and in nonformal education facilities. (NIER, 1990)

It should not be assumed that the Japanese approach to education should or could be superimposed on Americans. Unlike Japan, the American schools serve a more culturally-diverse student population. What works in Japan may not be appropriate in American schools. What works in Japan is not inherently efficient either. However, American education could adopt innovative practices from other countries if it offers the promise of addressing the needs of both individual and national interests.

Table 1
Context of Public Education in the United States and Japan

	United States	Japan
Ideal	Continuous Development of Individual	Competent Contribution of Group to the Group
Representative School	Comprehensive High, Liberal Arts College	Primary School
Scope	Cognitive Development, Civic Values, Social Skills	Whole Person, Wide Range of Subjects, Moral Values, Physical & Aesthetic Skills
Learning Theory	Aptitude & Growth	Effort
School & Classroom Technology	Individualized Courses & Instruction	Teacher Centered, Use of Groups, School as Unit
Administration	Decentralized	Quasi-decentralized
Admin. Style	Directive	Cooperation
Unit Cost	Variable	Moderate
Source of Government Finance	Local & State Funding	National Funding
Curriculum Decision Content Standards	 Local/State School	 National National/Local

Source: Cummings, W. K., Examining the Education Function: U.K., U.S., and Japanese Production Models. Chapman, D.W and Walberg, H.J. (ed), *International Perspectives on Educational Productivity*, Greenwich Company: JAI Press (1991).

Table 2
Time Devoted to Formal Schooling

	United States	Japan
Hours per Week	24	24/31
School Year (Days)	180	240
Average hours per day	5	4.6
Average Hours per year	900	1104
Hours of Math Home work	104	144
Hours of Science Instruction		
10 year-olds	252	336
14 year-olds	720	870

Sources: Hasen, 1967; and Passow et al.

Table 3

Percent Distribution of Teaching Hours by Subject

(Primary School)

	United States	Japan
% of time on National Language	47.9	36.0
% of time on Social Studies	20.5	8.0
% of time on Mathematics	7.6	16.0
% of time on Science	a	8.0
% of time on Physical Education	8.6	12.0
% Music/Handicraft	6.8	16.0
% Other	8.6	4.0

Source: Ministry of Education, Japan (1972). Educational Standards in Japan 1970. Tokyo: Ministry of Education, p. 59.

a: Data not available
* San Diego was selected for the U.S. example. The focus is on the second grade.

Table 4
Comparison of Intended, Implemented and Achieved Mathematics Curriculum in Japan and the United States

	Intended		Implemented		Achieved		
	U.S. %	Japan %	U.S. %	Japan %	U.S. %	Japan %	Int'l Mean
Grade 8							
Arithmetic	100	70	84	85	50	60	50
Algebra	60	80	67	83	42	61	43
Measurement	100	10[illegible]	74	95	41	62	51
Geometry	42	[illegible]	44	51	37	58	41
Statistics	96	1[illegible]	71	75	58	71	55
Grade 12							
Set, Relations & Functions	70	82	82	95	52	79	a
Number Systems	89	89	82	80	40	68	a
Algebra	88	91	89	100	42	78	57
Equation & Inequation	82	82	86	100	58	80	a
Geometry	65	79	61	90	32	60	42
Elementary Function & Calculus	92	98	58	92	28	67	a
Calculus	51	95	42	90	22	62	42
Probability & Statistics	85	100	46	82	41	70	a

Source: The IEA Study of Mathematics II: Contexts and Outcomes of School Mathematics, 1989.

Table 5
Context and Characteristics of Mathematics Education

	United States	Japan
Participation Rates		
% of Grade 12 age cohort in education	82	92
% of age group (20-40) in tertiary education	56	31
% of age cohort enrolling in advanced mathematics	13	12
Hours in Mathematics Per Week		
Grades 1 - 6	-	5
Grades 7 - 9	-	4
Grade 10	-	6
Grade 11	-	*3/6
Grade 12	-	*2/10
Proportion of Time for Mathematics		
Grade 8	14	13
Grade 12	14	20
Percent of Qualified Math Teachers		
Grade 8	63	91
Grade 12	92	97
Years of Teaching Mathematics		
Grade 8	6	9
Grade 12	10	9

Sources: 1) The IEA Study of Mathematics I: Analysis of Mathematics Curricula, 1989.
2) Japanese Education Today, U.S. Education Department, 1987.

* Figures reflect the number of hours of mathematics instruction for literature and science majors, respectively.

Table 6
Percent of an Age Group in Science Courses and Percent of Low Scoring Schools*

	United States		Japan	
	% in Science Course	% of Low Scoring Schools	% in Science Course	% of Low Scoring Schools
Grade 4/5	99	38	99	0
Grade 8/9	99	30	99	1
Grade 12/13				
Biology	6	98	12	84
Chemistry	1	48	16	14
Physics	1	89	11	36

Source: IEA Science Achievement in Seventeen Countries: A Preliminary Report, 1989.
* Percent of schools scoring lower than the lowest scoring schools in the highest scoring country.

Table 7
Science Achievement and Rank Order on Second IEA Science Tests

	United States			Japan		
	Mean Score	Rank Order	% of Curriculum Covered	Mean Score	Rank Order	% of Curriculum Covered
Grades 4/5	13.2	8	57	15.4	1	22
Grades 8/9	16.5	14	81	20.2	2	62
Grades 12/13						
Biology	37.9	13	100	46.2	10	100
Chemistry	37.7	11	100	51.9	4	100
Physics	45.5	9	100	56.1	4	95

Source: IEA Science Achievement in Seventeen Countries: A Preliminary Report, 1989.
Note: Comparisons are based on results from 15 countries for grades 4/5, 17 countries for grades 8/9, and 13 countries for grades 12/13.

Table 8
Time Devoted to Science Education, Japan - U.S.

	Hours Per Week (1)		Hours Per Year(2)	
	Japan	U.S	Japan	U.S.
Grade 1 & 2	2	a	68	57
Grade 3 to 6	3	a	105	105
Grade 7 & 8	3	a	103	108
Grade 9 & 10	4	a	140	108
Grade 11 & 12				
Literature majors	3	a	a	a
Science majors	8	a	a	a

Sources: (1) "Japanese Education Today," U.S Department of Education, 1987.
(2) "Analysis and Comparison of Science Curricula in Japan and the United States," 1986.
a: Data are not available.

Table 9
Classroom Organization

	Japan (Sendai)	United States (Chicago)
% of Time Student Spent In Activity Led by the Teacher	74	46
% of Time Not working with Any Students	6	13
% of Time No one Was Leading Instruction	26	51
% of Time Working with Individual Students	a	47
% of Time Working with Small Group	a	10
% of Lessons Ended with A Period of Seat work	23	59
% of Time Seat work Was Not Evaluated or Discussed	3	48

Source: Stigler, J. W. and Stevenson, H. W. (1991). "How Asian Teachers Polish Each Lesson to Perfection." Harold W. Stevenson and James W. Stigler (eds.) *Cultural Lessons: A New Look at the Education of American Children*, Summit Books.

Table 10
Parent Levels of Education*

	United States		Japan	
	Father	Mother	Father	Mother
Little or None	1	1	0	0
Primary	5	4	29	34
Secondary	27	43	41	54
Tertiary	68	53	30	12

* Parents of high school seniors.

Source: Robitaille, D.F. and Garden, R.A. (1989) The IEA Study of Mathematics II: Contexts and Outcomes of School Mathematics. Pergamon Press.

Table 11
Comparison of Average Teacher Salary in the United States and Japan (1983-84)

	U.S. Average Salary ($)	Japan Average Salary ($)	Japan as Percentage of U.S.
Elementary/lower secondary (Japan); elementary (U.S.)	21,452	20,254	94
Upper secondary (Japan) secondary (U.S.)	22,667	22,290	98
All levels combined	22,019	20.779	94
All levels combined, U.S. data adjusted to Japanese School year	21,476	20,779	97

Source: "U.S. Salary," NCES, 1985; "Japanese Salary," Ministry of Home Affairs, Tokyo, Japan, 1985.

Table 12
Public and Private Education Expenditure (1985)

	United States	Ranking	Japan	Ranking
* K-12 Instructional Expenditures Per Student by Purchasing Power Parity Index (PPP)	$3,310	2	$1,805	15
** Percent of Education Expenditures by Gross Domestic Product (GDP)				
K-12 and Higher Education	6.8	2	6.5	5
K-12	4.1	12	4.8	6
Percent of K-12 Expenditures Per Student by Per Capita Income	20.8	14	24.1	7

Source: * Hudson Institute, 1990, comparisons are made among 22 countries.
** Economic Policy Institute, 1990, comparisons are made among 16 countries.

Appendix A

Required Weekly Class Periods* in Each Subject in Elementary Schools in Japan

Subjects	Grade 1st	2nd	3rd	4th	5th	6th
Japanese	8	8	8	8	6	6
Social Studies	2	2	3	3	3	3
Arithmetic	4	5	5	5	5	5
Science	2	2	3	3	3	3
Music	2	2	2	2	2	2
Art & Handicraft	2	2	2	2	2	2
Homemaking	-	-	-	-	2	2
Physical Education	3	3	3	3	3	3
Moral Education	1	1	1	1	1	1
Special Activities	1	1	1	1	1	1
Total Number of Required Class Hours Per Week	25	26	28	29	29	29
Total Number of Class Hours Per Year	850	910	980	1015	1015	1015

* Each class period is 45 minutes long.

Appendix B

Required Weekly Class Periods(1) in Each Subject in Lower Secondary Schools in Japan

Required Subjects	7th grade	8th grade	9th grade
*Japanese Language	5	4	4
*Social Studies	4	4	3
*Mathematics	3	4	4
*Science	3	3	4
*Music	2	2	1
*Fine Arts	2	2	1
*Health and Physical Education	3	3	3
*Industrial Arts and Homemaking	2	2	3
Moral Education	1	1	1
Special Activities (2)	2	2	2
Elective subjects (3)	3	3	3
Total number of class hours per week	30	30	30
Total number of class hours per year	1,050	1,050	1,050

* Required subjects

(1) Each class hour is 50 minutes. The schools must give instruction for 35 weeks or more per year.
(2) "Special Activities" include pupils' assemblies, club activities, school events and guidance.
(3) "Elective Subjects" include foreign languages. The majority of pupils choose English as an elective subject.

Appendix C

General Education Subjects in Japanese Upper Secondary Schools and the Number of Credits for Each Subject

Subject Areas	Subjects	Number of Credits
Japanese Language	Japanese Language I	4
	Japanese Language II	4
	Japanese Language Expression	2
	Contemporary Japanese Language	4
	Contemporary Japanese Use and Usage	2
	Classics I	3
	Classics II	3
	Appreciation of Classics	2
Geography and History	World History A or	2
	World History B	4
	Japanese History A or	2
	Japanese History B or	4
	Geography A or	2
	Geography B or	4
Civics	Contemporary Society	4
	Ethics or	2
	Politics and Economy	2
Mathematics	Mathematics I	4
	Mathematics II	3
	Mathematics III	3
	Mathematics A	2
	Mathematics B	2
	Mathematics C	2

Appendix C (Cont.)

Subject Areas	Subjects	Number of Credits
Science (two subjects from among these five categories)	Integrated Science	4
	Physics IA	2
	Physics IB	4
	Chemistry IA	2
	Chemistry IB	4
	Chemistry II	2
	Biology IA	2
	Biology IB	4
	Biology II	2
	Earth Science IA	2
	Earth Science IB	4
	Earth Science II	2
Health and Physical Education	Physical Education	7-9
	Health	2
Art (one of these four subjets)	Music I	2
	Music II	2
	Music III	2
	Fine Arts I	2
	Fine Arts II	2
	Fine Arts III	2
	Crafts Production I	2
	Crafts Production II	2
	Crafts Production III	2
	Calligraphy I	2
	Calligraphy II	2
	Calligraphy III	2
Foreign Languages	English I	4
	English II	4
	Oral Communication A	2
	Oral Communication B	2
	Oral Communication C	2
	Reading	4

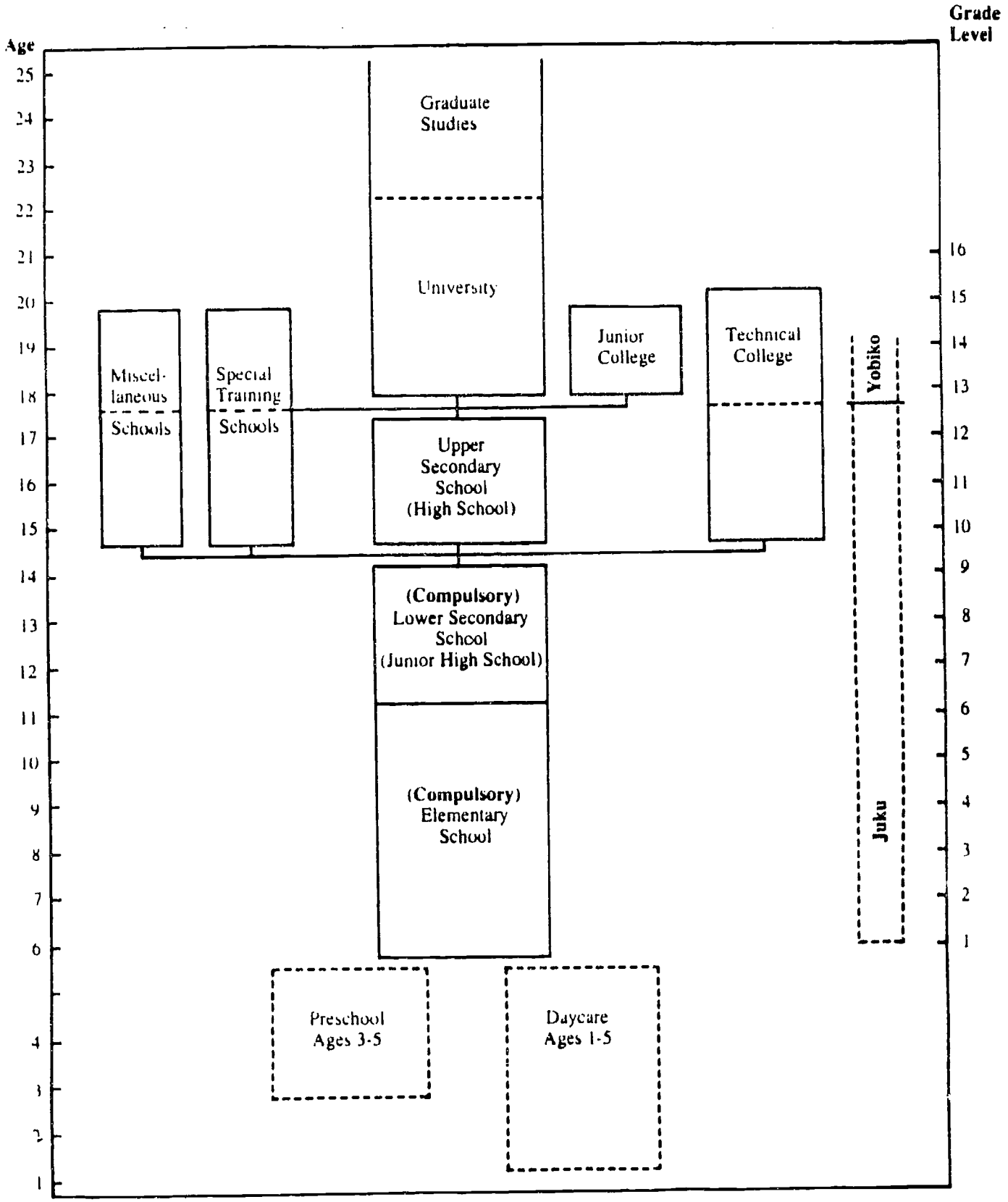
Appendix C (Cont.)

Subject Areas	Subjects	Number of Credits
Foreign Languages (cont.)	German French	
Home Economics	General Home Economics	4 (for girls)

Note: For both full-time and part-time courses, thirty-five school hours of lessons per school year are counted as one credit. One school hour lasts 50 minutes.

Source: National Institute for Educational Research (1990). **Basic Facts and Figures About the Educational System in Japan**, Tokyo, Japan.

Figure I: Structure of the Japanese Education System



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